01-21-10

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF HAWAII

- - - - In the Matter of - - - -	)	PUC Docket No. 2008-0273
	)	
PUBLIC UTILITIES COMMISSION	)	
	)	
Instituting a Proceeding to Investigate the Implementation of Feed-in Tariffs	)	
	)	
	)	

HAWAII RENEWABLE ENERGY ALLIANCE'S

COMMENTS AND RECOMMENDATIONS

REGARDING

HECO'S FIT TARIFF FILING

AND

CERTIFICATE OF SERVICE

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I. INTRODUCTION

By its Order filed on October 24, 2008, the Hawaii Public Utility Commission ("Commission") opened the instant docket, referred to hereafter as the "FiT" docket. The Commission, by its Order filed on November 28, 2008, granted the November 13, 2008 motion of Hawaii Renewable Energy Alliance ("HREA") to intervene in the FiT docket. In accordance with the Commission's Interim Decision and Order ("D&O") filed on September 25, 2009 and its Schedule Setting Order filed on October 29, 2009, HREA hereby submits this document, constituting its Comments and Recommendations regarding HECO's January 7, 2010 Filing to of its Proposed FiT Tariffs for the islands of Oahu, Maui, Molokai, Lanai and Hawaii.

By way of introduction and a brief summary, this document includes our comments and recommendations as follows.

A. Comments and Recommendations on the Proposed Costs, Performance Parameters, Financial Assumptions and Payment Rates for Tier 1 and 2 for Wind FiT projects. Specifically, we believe the proposed payment rates are too low to stimulate a market response, and we recommend higher payment rates;

B. Comments and Recommendations on the Proposed Financial Assumptions and Payment Rates for Tier 2 for PV FiT projects. Specifically, we are concerned that the proposed payments will result in a limited market response, and we recommend higher payment rates;

C. In addition, we have the following comments and recommendations, which we will not discuss further in this document:

- we defer to the Hawaii Solar Energy Association ("HSEA") and the Solar Alliance ("SA") regarding their comments and recommendations on the Proposed Costs, Performance Parameters, Financial Assumptions and Payment Rates for Tier 1 PV FiT projects;
- we defer to the Sopogy, Inc. regarding their comments and recommendations on the Proposed Costs, Performance Parameters, Financial Assumptions and Payment Rates for Tier 1 CSP FiT projects;
- we recommend, given the limited record in the FiT docket on the Proposed Costs, Performance Parameters, Financial Assumptions and Payment Rates for Tier 1 and 2 In-Line Hydro FiT projects, that the implementation of "in-line-hydro-specific FiTs be re-considered during the initial formal review of the FiT program . That said, we recommend further that Parties interested in developing in-line hydro projects be offered the opportunity to apply for and secure a FiT agreement under the "generic" category; and
- Finally, while we do not have any specific comments on the "non-price" elements of the proposed FiT tariffs at this time, we reserve the right to comment at later time if the opportunity arises.

II. COMMENTS AND RECOMMENDATIONS ON THE PROPOSED COSTS, PERFORMANCE PARAMETERS, FINANCIAL ASSUMPTIONS AND PAYMENT RATES FOR TIER 1 AND 2 FOR WIND FIT PROJECTS

Overall, HREA has reviewed, analyzed and evaluated HECO's proposed tariff rates for wind given the following criteria, which we believe incorporates specific direction from the Commission in its Interim D&O:

- Projects costs should be based on average or typical costs to installed and operate wind turbines in Hawaii, including actual projects in Hawaii, bona fide offers to potential clients, and use of existing PPAs and accepted competitive bids.[1] Specifically, our approach is to estimate average project costs for candidate wind turbines and simply average those values to arrive at recommended Tier 1 and Tier 2 payment rates;
- Project performance likewise should be based on average or typical wind sites in Hawaii. Specifically, for Tier 1 and Tier 2, we have chosen to base performance estimates on 12 mph average wind sites, where the 12 mph is measured at the international standard height of 10m. We note in general that HECO has selected higher wind sites that are suitable for windfarms, but are generally not where people live and work, and hence not suitable for Tier 1 and 2 FiT projects; and
- Average or typical financial assumptions should be made regarding equity and debt appropriate for residential and commercial projects. Specifically, we have identified key assumptions made by HECO that are simply not appropriate for wind projects, e.g., ROE and debt tenor, which will be discussed in more detail below. Moreover, HECO appears to have assumed that all projects will be commercial, and that is simply not the case for Tier 1 which will be primarily homeowner purchases

A. Tier 1 (0 to 20 kW)

Following the overall comments, we will discuss first project cost and performance, and then financial assumptions and estimates/recommendations for FiT payment rates.

Project Costs and Performance. First, we would like to review the list of candidate turbines for Tier 1 which are indicated in the table below.

Manufacturer	Size	Cost	Cost/kW	Model
Bergey	1kW	$ 4,432	$ 4,432	BWC XL.1-24 &1TU18
Southwest Windpower	1kW	$ 4,242	$ 4,242	Whisper 200
Southwest Windpower	2.4kW	$ 9,200	$ 3,833	SkyStream 3.7
Southwest Windpower	3kW	$ 12,660	$ 4,220	Whisper 500
Bergey min	10kW	$ 39,650	$ 3,965	BWC Excel-S/60
Bergey max	10kW	$ 46,700	$ 4,670	BWC Excel-S/61
Ventera min	10kW	$ 30,030	$ 3,003	
Ventera max	10kW	$ 42,430	$ 4,243	
Abundant RE	10kW	$ 39,600	$ 3,960	ARE 442
Jacobs min	20kW	$ 58,275	$ 2,914	31-20
Jacobs max	20kW	$ 69,950	$ 3,498	
Aerostar min	30kW	$ 82,725	$ 2,758	Aerostar 30
Aerostar max	30kW	$ 93,550	$ 3,118	
WindEnergySolutions	80kW	$ 260,000	$ 3,250	Wes 18
NorthernPower	100kW	$ 355,000	$ 3,550	NorthWind 100

Referring to HREA's Tier 1 Workpaper (attached), HREA recommends retention of only the Southwest Windpower ("SWWP") Skystream 2.4 kW and the Bergey 10 kW as candidate turbines for the following reasons:

- The Bergey 1 kW and SWWP 1 kW are battery chargers, not grid-tie systems,
- The Ventera 10 kW is not a commercial unit,
- Abundant is in bankruptcy with an uncertain future,
- The Jacobs 20 kW might be considered under Tier 2, but additional information and data are needed to conduct a thorough analysis.

Refer to our Workpaper for a summary of the model assumptions and inputs, including details on costs and performance estimates. You will note that we have analyzed four cases each with two or more scenarios as follows:

[1] Pg. 84 (D&O): "The commission encourages the use of existing Hawaii PPAs and accepted competitive

- Case 1: Skystream – Homeowner Purchase. The costs are the same as we provided to the Commission under protective cover in our filing on May 5, 2009. Please note Skystream hub height is approximately 10m, the same height for the reference wind speed of 12 mph. Using manufacturer annual output in kWh for 12 mph, the capacity factor for the Skystream is 21.4%. Please also note that the capacity factors used by HECO assumes use of a higher tower, which we have noted above is not appropriate for Hawaii.[2]
- Case 2: Two Skysteams – Small Commercial Project. The same assumptions were made as above for costs and performance, with the exception that there would be two Skystreams.
- Case 3: Bergey 10 kW – Homeowner Purchase. In this case, we have accepted the higher installed costs ($6,659) used by HECO as the "typical" for Hawaii. Per the workpaper, a 40ft tower is assumed resulting in a 15.2% capacity factor, based on manufacturer data.
- Case 4: Bergey 10 kW – Small Commercial Project. The same assumptions were made for costs and performance as for the homeowner purchase.

Financial Assumpions and FiT Payment Estimates/Recommendations. In addition to the Tier 1 Workpaper, we would like to refer you also to the individual case study spreadsheets. You will note one major in the financial assumptions from HECO's[3]:

- Debt Tenor: HREA knows of no wind projects that have a 20 year loan. For commercial projects, the appropriate tenor is 10 years, and for homeowner purchase would likely be 5 to 7 years at most;
- ROE: for Tier 1, although we believe investors will require a higher IRR, we have not modified the 11% ROE input, as we believe our recommended rate is sufficient;

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bids to evaluate the reasonableness of cost-based rates."

[2] We believe that tower heights over 60ft will generally not be acceptable for Tier 1 sites.

- o Homeowner Assumptions. We have assumed that the homeowner will put down 20%, and finance the balance. Therefore, with respect to the Black & Veatch model, we have set the ROE at 0%; and
- o Tax Incentives. We assumed that both the Federal ITC and the State RETITC can be monetized,

Referring to the four cases in the Tier 1 Workpaper, the estimated FiT payment rates vary from 33.8 cents/kWh to 37.3 cents/kWh with the average being 35.525 cents/kWh.

HREA therefore recommends that the Commission establish the Wind Tier 1 FIT payment rate at 35.525 cents/kWh. While this rate is remarkably higher than that proposed by HECO, it represents the rate at which projects will move forward in today's market. Whereas, we believe very little activity, if any at all, will be stimulated by HECO's proposal of 16.1 cents/kWh.

[3] We understand the HECO will be filing their workpapers on 1-21-10, which will facilitate comparisons.

B. Tier 2 (20 to 500 kW)

Following the overall comments, we will discuss first project cost and performance, and then financial assumptions and estimates/recommendations for FiT payment rates.

Project Costs and Performance. First, we would like to review the list of candidate turbines for Tier 2 which are indicated in the table below.

Manufacturer	Size	Cost	Cost/kW	Model
Bergey	1kW	$ 4,432	$ 4,432	BWC XL.1-24 &1TU18
Southwest Windpower	1kW	$ 4,242	$ 4,242	Whisper 200
Southwest Windpower	2.4kW	$ 9,200	$ 3,833	SkyStream 3.7
Southwest Windpower	3kW	$ 12,660	$ 4,220	Whisper 500
Bergey min	10kW	$ 39,650	$ 3,965	BWC Excel-S/60
Bergey max	10kW	$ 46,700	$ 4,670	BWC Excel-S/61
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Aerostar min	30kW	$ 82,725	$ 2,758	Aerostar 30
Aerostar max	30kW	$ 93,550	$ 3,118	
WindEnergySolutions	80kW	$ 260,000	$ 3,250	Wes 18
NorthernPower	100kW	$ 355,000	$ 3,550	NorthWind 100

Referring to HREA's Tier 2 Workpaper (attached), HREA recommends retention of only the Northern Power 100 kW turbine for the following reasons:

- The Jacobs 20 kW and Aerostar 30 kW, for reasons noted in the Tier 2 Workpaper, are not turbines being seriously considered by industry for Hawaii at this time,
- The Wind Energy Solutions 80 kW is a mature wind turbine. However, given that the company is based in Canada and the turbines are manufactured in the Netherlands, we question whether developers will find this turbine acceptable for Hawaii. That said, we are open to further consdieration of this turbine at a later time.
- In our May 5, 2009 filing of data and inforrmation to the Commission under protective order, we did propose rates for the Entregity 50 kW in Hawaii. However, given the uncertain financial status of the company at this time, we have not provided any follow-up analsis in the workpaper. See additional comments below.

Regarding the Northern Power and as noted in the Tier 2 Workpaper:

- After talking to potential project developers,[4] we believe the installed costs will be $5,500/kW, the fixed O&M cost will be $50/kW and the variable O&M costs will be $40/MWH.
- Given the same wind speed assumptions as in Tier 1, the estimated capacity factor for the 100 is 29.7%, which is substantially less from HECO's estimate. We believe the primary difference to be in the assumed wind speed at the turbine hub height of 121ft. Similar to our comments on Tier 1, we believe our assumptions are representative for Tier 2 wind sites as well, while HECO's are more representative of windfarm sites.

Financial Assumpions and FiT Payment Estimates/Recommendations. In addition to the Tier 2 Workpaper, we would like to refer you also to the attached Northern Power case study spreadsheet. As with Tier 1, we have similar comments about the financial assumptions used in the model:

- Debt Tenor. As with Tier 1 projects, we believe the appropriate tenor is 10 years;
- ROE. In Tier 2, we believe investors will require an IRR of at least 15%, if not 19%, for projects in Hawaii.[5] Thus, this issue is more important that for Tier 1. While we believe the FiT can do much to reduce the "upfront" development costs in Hawaii, that has yet to be shown. Consequently, until such time, it will be difficult to attract investors at 11%. We have assumed 15% for estimate of the payment rate, and indicate the sensitivity of ROE in the Workpaper, and
- Tax Incentives. We assumed that both the Federal ITC and the State RETITC can be monetized,

[4] Personal communication: 1-21-10.
[5] *Ibid.*

Referring to the four cases in the Tier 2 Workpaper, the estimated FiT payment rate is 24.7 cents/kWh.

Given that this payment rate is based only one wind turbine, the Northern Power 100, we would like to observe the following:

- We believe this is the most likely turbine to be deployed in Tier 2 in Hawaii;
- We would also like to note that our May 5, 2009 filing included a recommended payment rate of 29 cents/kWh (ROE of 15%) for the Entegrity 50 kW;
- While the availability of the Entegrity 50 kW is in question at the present time, we believe the proposed payment rate is representative;
- That said, we believe there is an argument that the Tier 2 Rate could or should be higher, so as to not disadvantage any smaller Tier 2 turbines; and
- We would also like to note that the First Wind 30 MW signed contract (now at the Commission) for a 30 MW windfarm at Kahuku includes an initial payment of approximately 17 cents/kWh with an annual escalator. Given the economy of scale associated with wind turbines, it is just not realistic to set a FiT rate lower than that for Tier 2 (or Tier 1 for that matter).

HREA therefore recommends that the Commission establish the Wind Tier 2 FIT payment rate at 25 cents/kWh. While this rate is remarkably higher than that proposed by HECO, it represents the rate at which projects will move forward in today's market. Whereas, we believe very little activity, if any at all, will be stimulated by HECO's proposal of 13.8 cents/kWh

III. COMMENTS AND RECOMMENDATIONS ON THE PROPOSED FINANCIAL ASSUMPTIONS AND PAYMENT RATES FOR TIER 2 FOR PV FIT PROJECTS

HREA noted issues with respect to financing wind projects above, especially with respect to Tier 2. We have similar concerns about Tier 2 PV projects, and will begin with a discussion of financial assumptions and end with a recommended FiT payment rate for Tier 2 PV.

Financial Assumptions. HREA believes the FIT pricing should be based on an unlevered financial model rather than trying to determine all the unknowns around future market debt terms. Returns are highly sensitive to debt terms if the exercise is based on levered after tax IRR ("Internal Rate of Return"). Basing the exercise on unlevered after tax returns would eliminate a whole set of input assumptions and the probability that they are not accurate projections of market conditions at the time such projects would be financed. If a FIT rate is based on debt assumptions and the debt markets change, then you either have a FIT that gives windfall profits or is so tight that none of the applicants can successfully finance the projects or few apply recognizing the risk. There is a ROE ("Return on Equity") that reflects the project risk independent from having any debt on the projects. Adding debt to a project increases risk to the project owner and therefore increase the corresponding return to the project owner. Unlevered analysis is not about "current market conditions", it is about the financial theory behind the exercise and the fact that debt is always subject to market conditions.

Our concerns with this levered model are that no debt service coverage reserves are assumed or modeled which would require additional up-front cash inflow or limit equity cash outflows until sufficient DSCR ("Debt Service Coverage Ratio") reserve levels would be established. That would require a higher LCOE to provide an 11% equity return. In the modeled case equity cash flows become negative after tax depreciation ceases; thus equity cash flows are front-ended loaded. In this case, equity investors would realize their entire positive equity

return by year 6, and debt holders would demand significant DSCR reserve levels to protect their investment and insure equity investors maintain the project financial integrity.

Assumptions Using the Levered Approach. If a levered model is used to establish FIT pricing, then a range of potential market debt terms needs to be included in the analysis to properly understand the effect of different debt terms on FIT rate and on IRR, referred to in the Black & Veatch model as ROE. The Black & Veatch model has been used by the parties to illustrate the sensitivity of production (Capacity Factor) and project cost on FIT rate, and there is consensus regarding specific production and cost values. However there has been less discussion and hence less agreement regarding the financial assumptions including both ROE and debt terms (e.g., debt percentage, debt interest rate, debt service coverage ratio, and debt tenor). In fact, ROE and debt terms have been held constant by HECO in their analysis.

Holding debt terms constant provides a frozen perspective on a financial environment which is anything but stagnant. Given that a Levered IRR is highly sensitive to debt terms, if the FIT modeling effort fails to include the full range of market debt terms in this analysis, then the FIT program will be highly sensitive to any fluctuations in the debt markets. That is, fluctuations in the debt markets could result in below market levered returns, and consequentially under enrollment in the FIT program, or above market levered returns.

HREA does not believe the debt terms used in the Black & Veatch model by HECO reflect commercially reasonable assumptions, thus solar PV project cash flows do not support the debt terms used in the model. Low Debt Service Coverage Ratios ("DSCRs") do not support project financing let alone any debt financing without significant DSCR reserves. Adequate DSCR reserve levels are required to protect their investment.

The tables below illustrate (1) the amount of debt that a project could support, given a market range of Debt Service Coverage Ratios ("DSCR") and market loan durations and (2) the Levered IRRs under two scenarios: (a) a fully efficient application of the project's tax benefits to

the owner's preexisting tax liability and (b) tax benefits that are self-sheltered by the project's tax liability.

Scenario 1: 35% tax credit, $0.189/kWh FIT rate. Table A illustrates the range of debt, as a percentage of total project cost, which a project could support given different DSCRs and different loan durations.

Case Assumptions - Scenario 1			
Installed Cost ($/kw)	5,645	FiT Rate	$189.09
Installed Capacity (kw/DC)	500	HI ITC	35%
1st Year Production (mwh)	709	Debt Rate	9.00%

Percent of Project Funded by Debt Given Term and DSCR Assumptions	**TABLE A**	DEBT SERVICE COVERAGE RATIO					
		1.25	**1.30**	**1.35**	**1.40**	**1.45**	**1.50**
TERM	12	18.67%	18.15%	17.47%	16.85%	16.27%	15.73%
	13	19.62%	18.88%	18.16%	17.51%	16.91%	16.35%
	14	20.29%	19.51%	18.78%	18.11%	17.49%	16.90%
	15	20.89%	20.08%	19.34%	18.65%	18.01%	17.41%
	16	21.43%	20.60%	19.84%	19.13%	18.47%	17.85%
	17	21.91%	21.07%	20.29%	19.56%	18.89%	18.26%
	18	22.34%	21.48%	20.69%	19.95%	19.26%	18.62%

Table B illustrates the Levered IRR if project tax benefits are efficiently utilized against the project owner's preexisting tax liability, given the debt percentages shown in Table A across different DSCRs and different loan durations.

Leveraged After-Tax Return (Efficient Tax Use)	**TABLE B**	DEBT SERVICE COVERAGE RATIO					
		1.25	**1.30**	**1.35**	**1.40**	**1.45**	**1.50**
DEBT TERM	12	6.07%	6.06%	6.05%	6.04%	6.03%	6.03%
	13	6.10%	6.09%	6.08%	6.07%	6.06%	6.05%
	14	6.14%	6.12%	6.11%	6.09%	6.08%	6.07%
	15	6.18%	6.16%	6.14%	6.12%	6.11%	6.10%
	16	6.22%	6.19%	6.17%	6.15%	6.14%	6.12%
	17	6.26%	6.23%	6.21%	6.19%	6.17%	6.15%
	18	6.31%	6.27%	6.25%	6.22%	6.20%	6.18%

Table C illustrates the Levered IRR if project tax benefits are utilized against the project's tax liability, given the debt percentages shown in Table A across different DSCRs and different loan durations.

Leveraged After-Tax Return (Self-Sheltered)	TABLE C	DEBT SERVICE COVERAGE RATIO					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	-3.28%	-3 19%	-3.10%	-3.03%	-2.96%	-2.89%
	13	-3.60%	-3.50%	-3.40%	-3.31%	-3.22%	-3.15%
	14	-3.98%	-3.83%	-3.72%	-3 61%	-3.51%	-3.42%
	15	-4.35%	-4 20%	-4.08%	-3.94%	-3.83%	-3.72%
	16	-4.78%	-4.61%	-4.45%	-4.30%	-4.17%	-4.05%
	17	-5.27%	-5 08%	-4.87%	-4.70%	-4.55%	-4.41%
	18	n/a	-5 57%	-5 35%	-5 15%	-4.98%	-4.80%

Scenario 2: 24.5% refundable tax credit, $0.238/kWh FIT rate.

Table D illustrates the range of debt, as a percentage of total project cost, which a project could support given different DSCRs and different loan durations.

Case Assumptions - Scenario 2			
Installed Cost ($/kw)	5,721	FiT Rate	$237.94
Installed Capacity (kw/DC)	500	HI ITC	25%
1st Year Production (mwh)	725	Debt Rate	9.00%

Percent of Project Funded by Debt Given Term and DSCR Assumptions	TABLE D	DEBT SERVICE COVERAGE RATIO					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	25.57%	24.59%	23.67%	22.83%	22.04%	21.31%
	13	26.60%	25.58%	24.63%	23.75%	22.93%	22.17%
	14	27.53%	26.47%	25.49%	24.58%	23.73%	22.94%
	15	28.37%	27.28%	26.27%	25.33%	24 45%	23.64%
	16	29.12%	28.00%	26.96%	26.00%	25.10%	24.27%
	17	29 80%	28.65%	27.59%	26.61%	25.69%	24.83%
	18	30.41%	29.24%	28.16%	27.15%	26.22%	25.34%

Table E illustrates the Levered IRR if project tax benefits are efficiently utilized against the project owner's preexisting tax liability, given the debt percentages shown in Table D across different DSCRs and different loan durations.

Leveraged After-Tax Return (Efficient Tax Use)	TABLE E	DEBT SERVICE COVERAGE RATIO					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	7.23%	7.19%	7.15%	7.11%	7.08%	7.06%
	13	7.36%	7.30%	7.25%	7.21%	7.17%	7.14%
	14	7.50%	7.43%	7.37%	7.32%	7.27%	7.23%
	15	7.65%	7.57%	7.49%	7.43%	7.37%	7 33%
	16	7.82%	7.72%	7.63%	7.55%	7.49%	7.43%
	17	8.02%	7.89%	7.78%	7.69%	7.61%	7.54%
	18	8.22%	8.07%	7.94%	7.83%	7.74%	7.65%

Table F illustrates the Levered Internal Rate of Return (IRR) if project tax benefits are utilized against the project's tax liability, given the debt percentages shown in Table D across different DSCRs and different loan durations.

Leveraged After-Tax Return (Self-Sheltered)	TABLE F	DEBT SERVICE COVERAGE RATIO					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	4.11%	4.17%	4.22%	4.26%	4.29%	4.32%
	13	3.89%	3.97%	4.04%	4.11%	4.17%	4.22%
	14	3.65%	3.75%	3.84%	3.92%	3.99%	4.05%
	15	3.39%	3.51%	3.62%	3.71%	3.80%	3.87%
	16	3.10%	3.25%	3.37%	3.48%	3.59%	3.68%
	17	2.78%	2.96%	3.11%	3.24%	3.36%	3.47%
	18	2.43%	2.64%	2.82%	2.98%	3.12%	3.25%

The Tables below present the same analysis as Scenarios 1 and 2, but with FIT rates that begin to present acceptable Levered IRR numbers.

Scenario 3: 24.5% refundable tax credit, $0.25/kWh FIT rate.

Table G illustrates the range of debt, as a percentage of total project cost, which a project could support given different DSCRs and different loan durations.

Case Assumptions - Scenario 3			
Installed Cost ($/kw)	5,721	FiT Rate	$250.00
Installed Capacity (kw/DC)	500	HI ITC	25%
1st Year Production (mwh)	725	Debt Rate	9.00%

Percent of Project Funded by Debt Given Term and DSCR Assumptions	TABLE G	DSCR					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	27.20%	26.16%	25.19%	24.29%	23.45%	22.67%
	13	28.30%	27.22%	26.21%	25.27%	24.40%	23.59%
	14	29.30%	28.17%	27.13%	26.16%	25.26%	24.41%
	15	30.19%	29.03%	27.96%	26.96%	26.03%	25.16%
	16	31.00%	29.81%	28.70%	27.68%	26.72%	25.83%
	17	31.73%	30.51%	29.38%	28.33%	27.35%	26.44%
	18	32.38%	31.14%	29.98%	28.91%	27.92%	26.99%

Table H illustrates the Levered IRR if project tax benefits are efficiently utilized against the project owner's preexisting tax liability, given the debt percentages shown in Table G across different DSCRs and different loan durations.

Leveraged After-Tax Return (Efficient Tax Use)	TABLE H	DSCR					
		1.25	1.30	1.35	1.40	1.45	1.50
DEBT TERM	12	8.26%	8.21%	8.14%	8.08%	8.03%	7.98%
	13	8.50%	8.40%	8.32%	8.24%	8.18%	8.12%
	14	8.74%	8.62%	8.51%	8.42%	8.34%	8.27%
	15	9.01%	8.86%	8.73%	8.62%	8.52%	8.44%
	16	9.31%	9.12%	8.96%	8.83%	8.71%	8.61%
	17	9.63%	9.41%	9.22%	9.05%	8.92%	8.79%
	18	9.98%	9.71%	9.48%	9.29%	9.13%	8.99%

Table I illustrates the Levered IRR if project tax benefits are utilized against the project's tax liability, given the debt percentages shown in Table G across different Debt Service Coverage Ratios and different loan durations.

Leveraged After-Tax Return (Self-Sheltered)	TABLE I	DSCR					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	4.90%	4.94%	4.97%	5.00%	5.03%	5.06%
	13	4.78%	4.83%	4.87%	4.91%	4.94%	4.97%
	14	4.65%	4.71%	4.76%	4.81%	4.85%	4.89%
	15	4.43%	4.53%	4.62%	4.70%	4.75%	4.79%
	16	4.18%	4.30%	4.41%	4.51%	4.60%	4.68%
	17	3.90%	4.05%	4.19%	4.30%	4.41%	4.50%
	18	3.59%	3.78%	3.94%	4.08%	4.20%	4.31%

Scenario 4: 24.5% refundable tax credit, $0.26/kWh FIT rate.

Table J illustrates the range of debt, as a percentage of total project cost, which a project could support given different DSCRs and different loan durations.

Case Assumptions - Scenario 4			
Installed Cost ($/kw)	5,721	FiT Rate	$260.00
Installed Capacity (kw/DC)	500	HI ITC	25%
1st Year Production (mwh)	725	Debt Rate	9.00%

Percent of Project Funded by Debt Given Term and DSCR Assumptions	TABLE J	DSCR					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	28.56%	27.48%	26.44%	25.50%	24.62%	23.80%
	13	29.72%	28.57%	27.52%	26.53%	25.62%	24.76%
	14	30.76%	29.58%	28.49%	27.47%	26.52%	25.64%
	15	31.71%	30.49%	29.36%	28.31%	27.34%	26.42%
	16	32.56%	31.31%	30.15%	29.07%	28.07%	27 13%
	17	33.33%	32.05%	30.86%	29.76%	28.73%	27.77%
	18	34.02%	32.71%	31.50%	30.37%	29.33%	28.35%

Table K illustrates the Levered IRR if project tax benefits are efficiently utilized against the project owner's preexisting tax liability, given the debt percentages shown in Table J across different Debt Service Coverage Ratios and different loan durations. **At a $0.26/kWh FIT rate, Levered IRRs start to approach 11% only at the most aggressive debt terms of 17-18 year duration and DSCRs of 1.25-1.3, as highlighted in grey below.**

Leveraged After-Tax Return (Efficient Tax Use)	TABLE K	DSCR					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	9.19%	9.08%	8.99%	8.90%	8.83%	8.76%
	13	9.49%	9.35%	9.23%	9.13%	9.04%	8.96%
	14	9.83%	9.68%	9.51%	9 38%	9.27%	9.17%
	15	10.21%	9.99%	9 81%	9.65%	9.51%	9.39%
	16	10.62%	10.36%	10.13%	9.94%	9.77%	9 63%
	17	11.07%	10.75%	10.48%	10.25%	10.05%	9.88%
	18	11.55%	11.16%	10.84%	10.57%	10.34%	10.14%

Table L illustrates the Levered IRR if project tax benefits are utilized against the project's tax liability, given the debt percentages shown in Table J across different DSCRs and different loan durations.

Leveraged After-Tax Return (Self-Sheltered)	TABLE L	DSCR					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	5.56%	5.59%	5.62%	5.64%	5.66%	5.68%
	13	5.47%	5.50%	5.54%	5.57%	5.60%	5.62%
	14	5.37%	5.41%	5.45%	5.49%	5.52%	5.55%
	15	5.26%	5.31%	5.36%	5.41%	5.45%	5.48%
	16	5.10%	5.21%	5.27%	5.32%	5.36%	5.40%
	17	4.87%	5.00%	5.11%	5.21%	5.28%	5.32%
	18	4.61%	4.77%	4.91%	5.02%	5.13%	5.22%

Scenario 5: 24.5% refundable tax credit, $0.27/kWh FIT rate.

Table M illustrates the range of debt, as a percentage of total project cost, which a project could support given different DSCRs and different loan durations.

Case Assumptions - Scenario 5			
Installed Cost ($/kw)	5,721	FiT Rate	$270.00
Installed Capacity (kw/DC)	500	HI ITC	25%
1st Year Production (mwh)	725	Debt Rate	9.00%

Percent of Project Funded by Debt Given Term and DSCR Assumptions	TABLE M	DSCR					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	29.91%	28.76%	27.70%	26.71%	25.79%	24.93%
	13	31.13%	29.93%	28.83%	27.80%	26.84%	25.94%
	14	32.23%	30.99%	29.84%	28.78%	27.79%	26.86%
	15	33.22%	31.95%	30.76%	29.66%	28.64%	27.69%
	16	34.12%	32.81%	31.59%	30.46%	29.41%	28.43%
	17	34.93%	33.58%	32.34%	31.18%	30.11%	29.11%
	18	35.65%	34.28%	33.01%	31.83%	30.74%	29.71%

Table N illustrates the Levered IRR if project tax benefits are efficiently utilized against the project owner's preexisting tax liability, given the debt percentages shown in Table M across different Debt Service Coverage Ratios and different loan durations. **At a $0.27/kWh FIT rate, Levered IRRs start to approach 11% within the debt terms of 15-18 year duration and DSCRs of 1.25-1.5, as highlighted in grey below.**

Leveraged After-Tax Return (Efficient Tax Use)	TABLE N	DSCR					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	10.13%	9.98%	9.86%	9.74%	9.65%	9.56%
	13	10.53%	10.35%	10.18%	10.04%	9.92%	9.81%
	14	10.98%	10.75%	10.54%	10.37%	10.22%	10.09%
	15	11.48%	11.19%	10.94%	10.72%	10.54%	10.38%
	16	12.03%	11.67%	11.36%	11.10%	10.88%	10.69%
	17	12.62%	12.18%	11.81%	11.51%	11.24%	11.02%
	18	13.23%	12.71%	12.28%	11.92%	11.62%	11.35%

Table O illustrates the Levered IRR if project tax benefits are utilized against the project's tax liability, given the debt percentages shown in Table M across different DSCRs and different loan durations.

Leveraged After-Tax Return (Self-Sheltered)	TABLE O	DSCR					
		1.25	1.30	1.35	1.40	1.45	1.50
TERM	12	6.24%	6.26%	6.28%	6.30%	6.31%	6.32%
	13	6.16%	6.21%	6.23%	6.25%	6.27%	6.28%
	14	6.11%	6.15%	6.18%	6.20%	6.22%	6.24%
	15	6.04%	6.08%	6.11%	6.14%	6.17%	6.20%
	16	5.96%	6.01%	6.05%	6.09%	6.12%	6.15%
	17	5.88%	5.93%	5.98%	6.02%	6.06%	6.10%
	18	5.68%	5.81%	5.91%	5.96%	6.00%	6.04%

FiT Rate Recommendation. Based on the illustration of Levered IRR sensitivities to a range of market debt terms, only at a rate of $0.27/kWh will the FIT Program start to provide the targeted 11% Levered IRR with market debt terms. Therefore, HREA supports a PV Tier 2 rate of $0.27/kWh

Final Comments on the Risk of Introducing Debt Financing Assumptions:

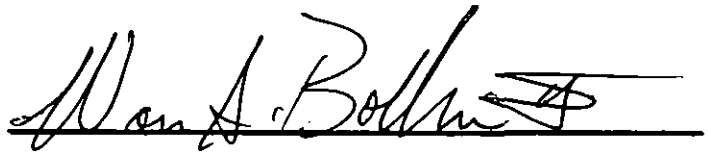
- Ideally, HREA believes the determination of FIT rate should be analyzed on a project, unlevered basis. A project should be able to stand on its own merit and should be a viable project regardless of any financing structure. Determination of FIT rate inclusive of debt introduces a new range of variables into the analysis, many of which will vary depending upon the developers underlying financial and tax situation, prospective lenders perception of the market, current interest rate environment and general state of the credit markets. Minimizing the number of variable assumptions

in the LCOE calculation should be paramount in this exercise. Appropriate unlevered returns for FIT projects would be 8 - 10% discount rate and HECO's proposed FIT rates under either state tax credit scenario result in unlevered FIT project returns below what would be acceptable for project returns. No DSCR reserves are assumed or modeled which would require additional up-front cash inflow or limit equity cash outflows until sufficient DSCR reserve levels would be established. In either case, a higher LCOE would be required to provide an 11% equity return.

- Equity cash flows become negative after tax depreciation ceases; thus equity cash flows are front-ended loaded. In fact, in the 35% HI tax credit scenario, 100% of the initial equity investment is recovered in year 1 from federal and state tax credits!
- In contrast, debt service payments are levelized over 20 years such that a substantial majority of debt service payments occur in years 6 through 20.
- Given that the equity investors would realized their entire positive equity return by year 6, debt holders would demand significant DSCR reserve levels to protect their investment and insure equity investors do not walk away from the project.

<This concludes our comments and recommendations>

DATED: January 21, 2010. Honolulu, Hawaii



Tier 1 - HREA Workpaper
Case Studies and Scenario Analysis

Case 1: Southwest Wind Power (SWWP) - Skystream - 2.4 kW - Residential Application - Homeowner Purchase - 5 yr Loan

Technology Assumptions	
Project Capacity (MW)	0.0024
Capital Cost ($/kW)	$8,953
Fixed O&M ($/kW)	$0
Fixed O&M Escalation	0.0%
Variable O&M ($/MWh)	$20
Variable O&M Escalation	2.5%
Insurance (% CapEx/year)	0.00%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Land (% royalty on revenues)	0.0%
Heat Rate (Btu/kWh)	0
Production Degradation (%/year)	0.00%
Capacity Factor	21.4%

Financial/Economic Asumptions		
Debt Percentage	80%	
Debt Rate	9%	
Debt Term (years)	5	
Economic Life (years)	20	
Depreciation Term (years)	5	N/A
Percent Depreciated	0%	
Cost of Generation Escalation	0.0%	
Federal Tax Rate (marginal)	35%	
State Tax Rate (effective)	6.015%	
State Excise Tax Rate (wholesale)	0.5%	
Cost of Equity	0%	
Discount Rate	9%	

Incentives		Cap
PTC ($/MWh)	0	0
PTC Escalation	0	0
PTC Term (years)	0	0
ITC	0.3	0
State Tax Credit	0.2	1,500
No. of Systems	1	0

Notes:
1) Not a commerical project
2) Homeowner puts 20% down
3) 5 year loan
4) 10m hub height
5) Sensitivity to CF is noted

Case 1: Scenarios 1 & 2: State/Federal Taxes Monetized, 5 yr Loan

Fit Payment Rate (CF = 21.4%) 33.9 LCOE

FiT Payment Rate@24.3% CF = 30.1 LCOE

Case 2: SWWP - Skystream - 4.8 kW - Small Commercial Application - 10 yr Loan

Technology Assumptions	
Project Capacity (MW)	0.0048
Capital Cost ($/kW)	$8,915
Fixed O&M ($/kW)	$0
Fixed O&M Escalation	2.5%
Variable O&M ($/MWh)	$20
Variable O&M Escalation	2.5%
Insurance (% CapEx/year)	0.60%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Land (% royalty on revenues)	4.0%
Heat Rate (Btu/kWh)	0
Production Degradation (%/year)	0.00%
Capacity Factor	24.3%

Financial/Economic Asumptions	
Debt Percentage	35%
Debt Rate	9%
Debt Term (years)	10
Economic Life (years)	20
Depreciation Term (years)	5
Percent Depreciated	100%
Cost of Generation Escalation	0.0%
Federal Tax Rate (marginal)	35%
State Tax Rate (effective)	6.015%
State Excise Tax Rate (wholesale)	0.5%
Cost of Equity	11%
Discount Rate	9%

Incentives		Cap
PTC ($/MWh)	0	0
PTC Escalation	0	0
PTC Term (years)	0	0
ITC	0.3	0
State Tax Credit	0.2	500,000
No. of Systems	2	0

Notes:
1) Small commecial project
2) 10 year loan
3) 10m hub height
4) Sensitivity to loan tenor is noted

Case 2: Scenarios 1-4: State/Federal Taxes Monetized, 10 year loan (Optional: 12 yr Loan)

Fit Payment Rate (CF = 21.4%) 35.3 10 year loan
34.2 12 year loan

FiT Payment Rate@24.3% CF = 31.4 10 year loan
30.4 12 year loan

Tier 1 - HREA Workpaper
Case Studies and Scenario Analysis

Case 3: Bergey - 10 kW - Residential Application - Homeowner Purchase

Technology Assumptions	
Project Capacity (MW)	0.01
Capital Cost ($/kW)	$6,659
Fixed O&M ($/kW)	$0
Fixed O&M Escalation	2.5%
Variable O&M ($/MWh)	$10
Variable O&M Escalation	2.5%
Insurance (% CapEx/year)	0.6%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Land (% royalty on revenues)	0.0%
Heat Rate (Btu/kWh)	0
Production Degradation (%/year)	0.00%
Capacity Factor	15.2%

Financial/Economic Asumptions		
Debt Percentage	80%	
Debt Rate	9%	
Debt Term (years)	7	
Economic Life (years)	20	
Depreciation Term (years)	5	N/A
Percent Depreciated	0%	
Cost of Generation Escalation	0.0%	
Federal Tax Rate (marginal)	35%	
State Tax Rate (effective)	6.015%	
State Excise Tax Rate (wholesale)	0.5%	
Cost of Equity	0%	
Discount Rate	9%	

Incentives		Cap
PTC ($/MWh)	0	0
PTC Escalation	0	0
PTC Term (years)	0	0
ITC	0.3	0
State Tax Credit	0.2	1,500
No. of Systems	1	0

Notes:
1) Not a commerical project
2) Homeowner puts 20% down
3) 7 year loan
4) Sensitivity to CF is noted

Case 3: Scenarios 1-2: State/Federal Taxes Monetized, 7 yr loan

Fit Payment Rate (CF = 15.2%) 37.4 LCOE

FiT Payment Rate@18.8% CF = 30.5

Case 4: Bergey - 10 kW - Small Commercial Application - Small Commercial Application - 10yr Loan

Technology Assumptions	
Project Capacity (MW)	0.01
Capital Cost ($/kW)	$6,659
Fixed O&M ($/kW)	$0
Fixed O&M Escalation	2.5%
Variable O&M ($/MWh)	$10
Variable O&M Escalation	2.5%
Insurance (% CapEx/year)	0.6%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Land (% royalty on revenues)	4.0%
Heat Rate (Btu/kWh)	0
Production Degradation (%/year)	0.00%
Capacity Factor	15.2%

Financial/Economic Asumptions		
Debt Percentage	35%	
Debt Rate	9%	
Debt Term (years)	10	
Economic Life (years)	20	
Depreciation Term (years)	5	N/A
Percent Depreciated	100%	
Cost of Generation Escalation	0.0%	
Federal Tax Rate (marginal)	35%	
State Tax Rate (effective)	6.015%	
State Excise Tax Rate (wholesale)	0.5%	
Cost of Equity	11%	
Discount Rate	9%	

Incentives		Cap
PTC ($/MWh)	0	0
PTC Escalation	0	0
PTC Term (years)	0	0
ITC	0.3	0
State Tax Credit	0.2	500,000
No. of Systems	1	0

Case 4: Scenarios 1-4: State/Federal Taxes Monetized, 10 - 12 year loan

Fit Payment Rate (CF = 15.2%) 35.7 10 year loan
34.6 12 year loan

Fit Payment Rate (CF = 18.8%) 29.1 10 year loan
28.2 12 year loan

Tier 1 - HREA Workpaper
Case Studies and Scenario Analysis

Summary Tier 1 Pricing

1. Skystream - Homeowner Purchase	33.8
2. Skystream - Commerical Project	35.3
3. Bergey - Homeowner Purchase	37.3
5. Bergey - Commercial Project	35.7
Average:	35.525

Notes on Turbines Not Considered for the Analysis in Tier 1

The following turbines should not be included for analysis and calculation of the Tier 1 FiT Payment Rate for the following reasons:

1. Bergey 1 kW is a battery charger and hence not a grid-tie turbine

2. SWWP 1 KW is also a battery charger and hence not a grid-tie turbine

3. Ventera - 10 kW is not considered for analysis in Tier 1 for the following reasons:
   a. Ventera's web-site does not have any power curve and related energy output data
   b. No way to verify performance, i.e., CF at 12 mph (at 10m) resource site
   c. No way to confirm number of turbines deployed, where, and theiir performance
   d. We do not consider this to be a commercial turbine
   e. Recommend not including as a turbine to analyze for calcuation of the FiT Payment Rate

4. Abundant - 10 kW should not be considered for analysis in Tier 1 for the following reasons:
   a. Abundant has power curve of its web-site, but no claim as to if it was prepared according to AWEA standards
   b. Provides estimates but no informatino on tower height and reference point for average wind speeds used
   c. Claim of 1890 kWh/month at 12 mph is quite high; tower height is not noted
   d. Turbine price of $39,600 does NOT include tower and shipping
   e. No pricing on towers and estimate shipping
   f. We undestand that Abundant is in bankruptcy proceedings

5. Jacobs 20 kW – this turbine could be considered but:
   a. Need to confirm turbine availability, pricing and performance data
   b. That said, the Jacobs is based on 1930's technology and historically Jacobs turbines installed in Hawaii have not done well.

Tier 1 - HREA Workpaper
Case Studies and Scenario Analysis

Detailed Technical Calculations and Related Assumptions

Overall Assumptions

1. Costs are Hawaii-specific
2. Capacity factors is for Class 3 (12 mph) and wind shear factor of 0.18

4. Wind Shear

V (hub height)_ = V (10m)*(Zhub/10m)*POWER(α)

α =	0.18
V (10m) =	12 mph
Z10m =	32.8 feet

Hub Height	Mph
32.8	12.0
40	12.4
60	13.4
80	14.1

3. Wind Class

Class	10m (32.8 ft) w/m2	mph	m/s	mph	m/s
1	0 - 100	<9.8	<4.4	<12.5	<5.6
2	100 - 150	9.8-11.5	4.4-5.1	12.5-14.3	5.6-6.4
3	150 - 200	11.5-12.5	5.1-5.6	14.3-15.7	6.4-7.0
4	200 - 250	12.5-13.4	5.6-6.0	15.7-16.8	7.0-7.5
5	250 - 300	13.4-14.3	6.0-6.4	16.8-17.9	7.5-8.0
6	300 - 400	14.3-15.7	6.4-7.0	17.9-19.7	8.0-8.8
7	400 - 1000	15.7-21.1	7.0-9.4	19.7 - 26.6	8.8-11.9

Skystream Calculations

		kWh/mo	kWh/hr	CF
Class 3	12 mph	375	4500	21.4%
Class 4	13 mph	425	5100	24.3%

Bergey Calculations:

		kWh/mo	kWh/hr	CF	
Class 3	12 mph	1110	13320	15.2%	60 ft tower
		1370	16440	18.8%	80 ft tower
Class 4	13 mph	1350	16200	18.5%	60 ft tower
		1670	20400	23.3%	80 ft tower
Class 5	14 mph	1610	19320	22%	60 ft tower
		1960	23520	27%	80 ft tower

Homeowner Payback Periods	**Cost**	**CF**	**Annual kWh**	**Price**	**Revenue**	**Years**
1) Skystream	21,487.20	0.21	4499	0.339	1525	14.09
		0.24	4499	0.301	1354	15.87
		0.24	5046	0.156	787	27.30
		0.21	4415	0.156	689	31.20
2) Price needed given likely		0.24	5046	0.608	3068	7.00
payback period max threshold		0.21	4415	0.695	3068	7.00

Cost of Generation Calculator

All inputs are in blue.

Tier 1 Wind Project - Case 1: Skystream - Homeowner Purchase with 5 yr Loan

Technology Assumptions	
Project Capacity (MW)	0.0024
Capital Cost ($/kW)	$8,953
Fixed O&M ($/kW)	$0
Fixed O&M Escalation	2.5%
Variable O&M ($/MWh)	$20
Variable O&M Escalation	2.5%
Insurance (% CapEx/year)	0.00%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Land (% royalty on revenues)	0.0%
Heat Rate (Btu/kWh)	0
Production Degradation (%/year)	0.00%
Capacity Factor	21.4%

Financial/Economic Asumptions	
Debt Percentage	80%
Debt Rate	9%
Debt Term (years)	5
Economic Life (years)	20
Depreciation Term (years)	5
Percent Depreciated	0%
Cost of Generation Escalation	0.0%
Federal Tax Rate (marginal)	35%
State Tax Rate (effective)	6.015%
State Excise Tax Rate (wholesa	0.5%
Cost of Equity	0%
Discount Rate	9%

Incentives		Cap
PTC ($/MWh)	$0	
PTC Escalation	0.0%	
PTC Term (years)	0	
ITC	30%	
State Tax Credit	20%	$ 1,500
No. of Systems	1	

Outputs	
NPV for Equity Return	$0
Levelized Cost of Generation	$338.72

Year		1	2	3	4	5	6	7	8	9	10	11
Annual Generation (MWh)		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Cost of Generation ($/mWh)		$338.72	$338.72	$338.72	$338.72	$338.72	$338.72	$338.72	$338.72	$338.72	$338.72	$338.72
Operating Revenues		**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**
Fixed O&M		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Variable O&M		$90	$92	$95	$97	$99	$102	$104	$107	$110	$112	$115
Insurance		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land Cost		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fuel Cost		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Excise Tax		$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8
Operating Expenses		**$98**	**$100**	**$102**	**$105**	**$107**	**$109**	**$112**	**$115**	**$117**	**$120**	**$123**
Interest Payment		$1,547	$1,289	$1,007	$700	$365	$0	$0	$0	$0	$0	$0
Principal Payment		$2,872	$3,131	$3,413	$3,720	$4,054	$0	$0	$0	$0	$0	$0
Debt Service		**$4,419**	**$4,419**	**$4,419**	**$4,419**	**$4,419**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Tax Depreciation - State		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - State		$1,379	$136	$415	$720	$1,052	$1,415	$1,412	$1,409	$1,407	$1,404	$1,401
State Income Tax (benefit)		$83	$8	$25	$43	$63	$85	$85	$85	$85	$84	$84
Tax Depreciation - Fed'l		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - Fed'l		$1,296	$127	$390	$676	$989	$1,329	$1,327	$1,325	$1,322	$1,320	$1,317
Federal Income Tax (benefit)		$454	$45	$137	$237	$346	$465	$464	$464	$463	$462	$461
PTC		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal ITC		$6,446										
State Tax Credit		$1,500										
Net Taxes (due)		**$7,409**	**($53)**	**($161)**	**($280)**	**($409)**	**($550)**	**($549)**	**($548)**	**($547)**	**($546)**	**($545)**
Net Cash Flow	***(4,297)***	***4,416***	***(3,048)***	***(3,159)***	***(3,280)***	***(3,412)***	***864***	***863***	***861***	***859***	***858***	***856***

Cost of Generation

All inputs are in blue.

Technology Assumptions	Calculation		
Project Capacity (MW)			
Capital Cost ($/kW)	Cap Cost	$	21,487
Fixed O&M ($/kW)	Fed'l depreciation basis	$	(3,223)
Fixed O&M Escalation	State depreciation basis	$	-
Variable O&M ($/MWh)			
Variable O&M Escalation		0	
Insurance (% CapEx/year)		0	-18526.60893
Fuel Cost ($/MBtu)		5	-18253.12986
Fuel Cost Escalation	slope		54.69581526
Land (% royalty on revenues)			
Heat Rate (Btu/kWh)			
Production Degradation (%/year)			
Capacity Factor			

Year	12	13	14	15	16	17	18	19	20
Annual Generation (MWh)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Cost of Generation ($/mWh)	$338.72	$338.72	$338.72	$338.72	$338.72	$338.72	$338.72	$338.72	$338.72
Operating Revenues	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**	**$1,524**
Fixed O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0
Variable O&M	$118	$121	$124	$127	$130	$134	$137	$140	$144
Insurance	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fuel Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0
Excise Tax	$8	$8	$8	$8	$8	$8	$8	$8	$8
Operating Expenses	**$126**	**$129**	**$132**	**$135**	**$138**	**$141**	**$145**	**$148**	**$151**
Interest Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Principal Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Debt Service	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Tax Depreciation - State	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - State	$1,398	$1,395	$1,392	$1,389	$1,386	$1,383	$1,379	$1,376	$1,372
State Income Tax (benefit)	$84	$84	$84	$84	$83	$83	$83	$83	$83
Tax Depreciation - Fed'l	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - Fed'l	$1,314	$1,311	$1,309	$1,306	$1,303	$1,300	$1,296	$1,293	$1,290
Federal Income Tax (benefit)	$460	$459	$458	$457	$456	$455	$454	$453	$451
PTC	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal ITC									
State Tax Credit									
Net Taxes (due)	**($544)**	**($543)**	**($542)**	**($541)**	**($539)**	**($538)**	**($537)**	**($535)**	**($534)**
Net Cash Flow	***854***	***852***	***851***	***849***	***847***	***845***	***843***	***841***	***838***

Cost of Generation Calculator

All inputs are in blue.

Tier 1 Wind Project - Case 2: Skystreams - Small Commerical Project

Technology Assumptions	
Project Capacity (MW)	0.0048
Capital Cost ($/kW)	$8,915
Fixed O&M ($/kW)	$0
Fixed O&M Escalation	2.5%
Variable O&M ($/MWh)	$20
Variable O&M Escalation	2.5%
Insurance (% CapEx/year)	0.60%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Land (% royalty on revenues)	4.0%
Heat Rate (Btu/kWh)	0
Production Degradation (%/year)	0.00%
Capacity Factor	21.4%

Financial/Economic Asumptions	
Debt Percentage	35%
Debt Rate	9%
Debt Term (years)	10
Economic Life (years)	20
Depreciation Term (years)	5
Percent Depreciated	100%
Cost of Generation Escalation	0.0%
Federal Tax Rate (marginal)	35%
State Tax Rate (effective)	6.015%
State Excise Tax Rate (wholesa	0.5%
Cost of Equity	11%
Discount Rate	9%

Incentives		Cap
PTC ($/MWh)	$0	
PTC Escalation	0.0%	
PTC Term (years)	0	
ITC	30%	
State Tax Credit	20%	$ 500,000
No. of Systems	1	

Outputs	
NPV for Equity Return	$0
Levelized Cost of Generation	$352.71

Year	1	2	3	4	5	6	7	8	9	10	11
Annual Generation (MWh)	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Cost of Generation ($/mWh)	$352.71	$352.71	$352.71	$352.71	$352.71	$352.71	$352.71	$352.71	$352.71	$352.71	$352.71
Operating Revenues	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**
Fixed O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Variable O&M	$180	$184	$189	$194	$199	$204	$209	$214	$219	$225	$230
Insurance	$257	$263	$270	$276	$283	$290	$298	$305	$313	$321	$329
Land Cost	$127	$127	$127	$127	$127	$127	$127	$127	$127	$127	$127
Fuel Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Excise Tax	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16
Operating Expenses	**$580**	**$590**	**$602**	**$613**	**$625**	**$637**	**$649**	**$662**	**$675**	**$688**	**$702**
Interest Payment	$1,348	$1,259	$1,163	$1,057	$942	$817	$680	$532	$369	$193	$0
Principal Payment	$986	$1,075	$1,171	$1,277	$1,392	$1,517	$1,653	$1,802	$1,964	$2,141	$0
Debt Service	**$2,334**	**$2,334**	**$2,334**	**$2,334**	**$2,334**	**$2,334**	**$2,334**	**$2,334**	**$2,334**	**$2,334**	**$0**
Tax Depreciation - State	$8,558	$13,693	$8,216	$4,930	$4,930	$2,465	$0	$0	$0	$0	$0
Taxable Income - State	$1,246	($12,369)	($6,806)	($3,426)	($3,323)	($745)	$1,844	$1,980	$2,129	$2,293	$2,472
State Income Tax (benefit)	$75	($744)	($409)	($206)	($200)	($45)	$111	$119	$128	$138	$149
Tax Depreciation - Fed'l	$7,275	$11,639	$6,984	$4,190	$4,190	$2,095	$0	$0	$0	$0	$0
Taxable Income - Fed'l	$2,455	($9,571)	($5,165)	($2,481)	($2,384)	($330)	$1,733	$1,861	$2,001	$2,155	$2,323
Federal Income Tax (benefit)	$859	($3,350)	($1,808)	($868)	($834)	($116)	$607	$651	$700	$754	$813
PTC	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal ITC	$12,838										
State Tax Credit	$8,558										
Net Taxes (due)	**$20,462**	**$4,094**	**$2,217**	**$1,074**	**$1,034**	**$160**	**($718)**	**($770)**	**($829)**	**($892)**	**($962)**
Net Cash Flow	***(27,815)***	***20,722***	***4,344***	***2,455***	***1,301***	***1,249***	***364***	***(527)***	***(592)***	***(663)***	***(740)***	***1,510***

Cost of Generation

All inputs are in blue.

Technology Assumptions	Calculation		
Project Capacity (MW)			
Capital Cost ($/kW)	Cap Cost	$	42,792
Fixed O&M ($/kW)	Fed'l depreciation basis	$	36,373
Fixed O&M Escalation	State depreciation basis	$	42,792
Variable O&M ($/MWh)			
Variable O&M Escalation		0	
Insurance (% CapEx/year)		0	-13283.8529
Fuel Cost ($/MBtu)		5	-13095.54175
Fuel Cost Escalation	slope		37.66222926
Land (% royalty on revenues)			
Heat Rate (Btu/kWh)			
Production Degradation (%/year)			
Capacity Factor			

Year	12	13	14	15	16	17	18	19	20
Annual Generation (MWh)	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Cost of Generation ($/mWh)	$352.71	$352.71	$352.71	$352.71	$352.71	$352.71	$352.71	$352.71	$352.71
Operating Revenues	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**	**$3,174**
Fixed O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0
Variable O&M	$236	$242	$248	$254	$261	$267	$274	$281	$288
Insurance	$337	$345	$354	$363	$372	$381	$391	$400	$410
Land Cost	$127	$127	$127	$127	$127	$127	$127	$127	$127
Fuel Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0
Excise Tax	$16	$16	$16	$16	$16	$16	$16	$16	$16
Operating Expenses	**$716**	**$730**	**$745**	**$760**	**$775**	**$791**	**$807**	**$824**	**$841**
Interest Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Principal Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Debt Service	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Tax Depreciation - State	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - State	$2,458	$2,444	$2,429	$2,414	$2,398	$2,383	$2,366	$2,350	$2,333
State Income Tax (benefit)	$148	$147	$146	$145	$144	$143	$142	$141	$140
Tax Depreciation - Fed'l	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - Fed'l	$2,310	$2,297	$2,283	$2,269	$2,254	$2,239	$2,224	$2,208	$2,192
Federal Income Tax (benefit)	$809	$804	$799	$794	$789	$784	$778	$773	$767
PTC	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal ITC									
State Tax Credit									
Net Taxes (due)	**($956)**	**($951)**	**($945)**	**($939)**	**($933)**	**($927)**	**($921)**	**($914)**	**($908)**
Net Cash Flow	***1,502***	***1,493***	***1,484***	***1,475***	***1,465***	***1,456***	***1,446***	***1,436***	***1,425***

Cost of Generation Calculator

All inputs are in blue.

Tier 1 Wind Project - Case 3: Bergey 10 kW - Homeowner Purchase with 7 yr Loan

Technology Assumptions	
Project Capacity (MW)	0.01
Capital Cost ($/kW)	$6,659
Fixed O&M ($/kW)	$0
Fixed O&M Escalation	2.5%
Variable O&M ($/MWh)	$10
Variable O&M Escalation	2.5%
Insurance (% CapEx/year)	0.00%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Land (% royalty on revenues)	0.0%
Heat Rate (Btu/kWh)	0
Production Degradation (%/year)	0.00%
Capacity Factor	15.2%

Financial/Economic Asumptions	
Debt Percentage	80%
Debt Rate	9%
Debt Term (years)	7
Economic Life (years)	20
Depreciation Term (years)	5
Percent Depreciated	0%
Cost of Generation Escalation	0.0%
Federal Tax Rate (marginal)	35%
State Tax Rate (effective)	6.015%
State Excise Tax Rate (wholesa	0.5%
Cost of Equity	0%
Discount Rate	9%

Incentives		Cap
PTC ($/MWh)	$0	
PTC Escalation	0.0%	
PTC Term (years)	0	
ITC	30%	
State Tax Credit	20%	$ 1,500
No. of Systems	1	

Outputs	
NPV for Equity Return	$0
Levelized Cost of Generation	$373.71

Year	1	2	3	4	5	6	7	8	9	10	11
Annual Generation (MWh)	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Cost of Generation ($/mWh)	$373.71	$373.71	$373.71	$373.71	$373.71	$373.71	$373.71	$373.71	$373.71	$373.71	$373.71
Operating Revenues	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**
Fixed O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Variable O&M	$133	$136	$140	$143	$147	$151	$154	$158	$162	$166	$170
Insurance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fuel Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Excise Tax	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Operating Expenses	**$158**	**$161**	**$165**	**$168**	**$172**	**$176**	**$179**	**$183**	**$187**	**$191**	**$195**
Interest Payment	$4,794	$4,273	$3,705	$3,086	$2,411	$1,676	$874	$0	$0	$0	$0
Principal Payment	$5,790	$6,311	$6,879	$7,498	$8,173	$8,909	$9,711	$0	$0	$0	$0
Debt Service	**$10,585**	**$10,585**	**$10,585**	**$10,585**	**$10,585**	**$10,585**	**$10,585**	**$0**	**$0**	**$0**	**$0**
Tax Depreciation - State	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - State	$1,524	$541	$1,106	$1,722	$2,393	$3,125	$3,923	$4,793	$4,789	$4,785	$4,781
State Income Tax (benefit)	$92	$33	$67	$104	$144	$188	$236	$288	$288	$288	$288
Tax Depreciation - Fed'l	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - Fed'l	$1,432	$509	$1,039	$1,618	$2,249	$2,937	$3,687	$4,505	$4,501	$4,497	$4,493
Federal Income Tax (benefit)	$501	$178	$364	$566	$787	$1,028	$1,290	$1,577	$1,575	$1,574	$1,573
PTC	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal ITC	$19,977										
State Tax Credit	$1,500										
Net Taxes (due)	**$20,884**	**($211)**	**($430)**	**($670)**	**($931)**	**($1,216)**	**($1,526)**	**($1,865)**	**($1,863)**	**($1,862)**	**($1,860)**
Net Cash Flow	***(13,318)***	***15,118***	***(5,981)***	***(6,204)***	***(6,447)***	***(6,711)***	***(7,000)***	***(7,314)***	***2,928***	***2,926***	***2,923***	***2,921***

Cost of Generation

All inputs are in blue.

Technology Assumptions	Calculation		
Project Capacity (MW)			
Capital Cost ($/kW)	Cap Cost	$	66,590
Fixed O&M ($/kW)	Fed'l depreciation basis	$	(9,989)
Fixed O&M Escalation	State depreciation basis	$	-
Variable O&M ($/MWh)			
Variable O&M Escalation	0		
Insurance (% CapEx/year)	0	-60493.81099	
Fuel Cost ($/MBtu)	5	-59684.44923	
Fuel Cost Escalation	slope	161.8723505	
Land (% royalty on revenues)			
Heat Rate (Btu/kWh)			
Production Degradation (%/year)			
Capacity Factor			

Year	12	13	14	15	16	17	18	19	20
Annual Generation (MWh)	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Cost of Generation ($/mWh)	$373.71	$373.71	$373.71	$373.71	$373.71	$373.71	$373.71	$373.71	$373.71
Operating Revenues	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**	**$4,976**
Fixed O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0
Variable O&M	$175	$179	$184	$188	$193	$198	$203	$208	$213
Insurance	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fuel Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0
Excise Tax	$25	$25	$25	$25	$25	$25	$25	$25	$25
Operating Expenses	**$200**	**$204**	**$208**	**$213**	**$218**	**$223**	**$227**	**$233**	**$238**
Interest Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Principal Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Debt Service	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Tax Depreciation - State	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - State	$4,776	$4,772	$4,768	$4,763	$4,758	$4,754	$4,749	$4,744	$4,738
State Income Tax (benefit)	$287	$287	$287	$286	$286	$286	$286	$285	$285
Tax Depreciation - Fed'l	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - Fed'l	$4,489	$4,485	$4,481	$4,477	$4,472	$4,468	$4,463	$4,458	$4,453
Federal Income Tax (benefit)	$1,571	$1,570	$1,568	$1,567	$1,565	$1,564	$1,562	$1,560	$1,559
PTC	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal ITC									
State Tax Credit									
Net Taxes (due)	**($1,859)**	**($1,857)**	**($1,855)**	**($1,853)**	**($1,851)**	**($1,850)**	**($1,848)**	**($1,846)**	**($1,844)**
Net Cash Flow	***2,918***	***2,915***	***2,913***	***2,910***	***2,907***	***2,904***	***2,901***	***2,898***	***2,895***

Cost of Generation Calculator

All inputs are in blue.

Tier 1 Wind Project - Case 4: Bergey 10 kW Small Commercial Project

Technology Assumptions	
Project Capacity (MW)	0.01
Capital Cost ($/kW)	$6,659
Fixed O&M ($/kW)	$0
Fixed O&M Escalation	2.5%
Variable O&M ($/MWh)	$10
Variable O&M Escalation	2.5%
Insurance (% CapEx/year)	0.6%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Land (% royalty on revenues)	4.0%
Heat Rate (Btu/kWh)	0
Production Degradation (%/year)	0.00%
Capacity Factor	15.2%

Financial/Economic Asumptions	
Debt Percentage	35%
Debt Rate	9%
Debt Term (years)	10
Economic Life (years)	20
Depreciation Term (years)	5
Percent Depreciated	100%
Cost of Generation Escalation	0.0%
Federal Tax Rate (marginal)	35%
State Tax Rate (effective)	6.015%
State Excise Tax Rate (wholesa	0.5%
Cost of Equity	11%
Discount Rate	9%

Incentives		Cap
PTC ($/MWh)	$0	
PTC Escalation	0.0%	
PTC Term (years)	0	
ITC	30%	
State Tax Credit	20%	$ 500,000
No. of Systems	1	

Outputs	
NPV for Equity Return	$0
Levelized Cost of Generation	$357.32

Year	1	2	3	4	5	6	7	8	9	10	11
Annual Generation (MWh)	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Cost of Generation ($/mWh)	$357.32	$357.32	$357.32	$357.32	$357.32	$357.32	$357.32	$357.32	$357.32	$357.32	$357.32
Operating Revenues	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**
Fixed O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Variable O&M	$133	$136	$140	$143	$147	$151	$154	$158	$162	$166	$170
Insurance	$400	$410	$420	$430	$441	$452	$463	$475	$487	$499	$511
Land Cost	$190	$190	$190	$190	$190	$190	$190	$190	$190	$190	$190
Fuel Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Excise Tax	$24	$24	$24	$24	$24	$24	$24	$24	$24	$24	$24
Operating Expenses	**$747**	**$760**	**$774**	**$788**	**$802**	**$817**	**$832**	**$847**	**$863**	**$879**	**$896**
Interest Payment	$2,098	$1,960	$1,809	$1,645	$1,466	$1,271	$1,059	$827	$575	$300	$0
Principal Payment	$1,534	$1,672	$1,823	$1,987	$2,165	$2,360	$2,573	$2,804	$3,057	$3,332	$0
Debt Service	**$3,632**	**$3,632**	**$3,632**	**$3,632**	**$3,632**	**$3,632**	**$3,632**	**$3,632**	**$3,632**	**$3,632**	**$0**
Tax Depreciation - State	$13,318	$21,309	$12,785	$7,671	$7,671	$3,836	$0	$0	$0	$0	$0
Taxable Income - State	$1,913	($19,271)	($10,610)	($5,346)	($5,182)	($1,166)	$2,867	$3,083	$3,320	$3,579	$3,862
State Income Tax (benefit)	$115	($1,159)	($638)	($322)	($312)	($70)	$172	$185	$200	$215	$232
Tax Depreciation - Fed'l	$11,320	$18,112	$10,867	$6,520	$6,520	$3,260	$0	$0	$0	$0	$0
Taxable Income - Fed'l	$3,796	($14,915)	($8,054)	($3,874)	($3,719)	($520)	$2,695	$2,898	$3,120	$3,363	$3,629
Federal Income Tax (benefit)	$1,329	($5,220)	($2,819)	($1,356)	($1,302)	($182)	$943	$1,014	$1,092	$1,177	$1,270
PTC	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal ITC	$19,977										
State Tax Credit	$13,318										
Net Taxes (due)	**$31,851**	**$6,379**	**$3,457**	**$1,677**	**$1,613**	**$252**	**($1,116)**	**($1,200)**	**($1,292)**	**($1,392)**	**($1,503)**
Net Cash Flow	***(43,284)***	***32,231***	***6,745***	***3,810***	***2,016***	***1,938***	***562***	***(821)***	***(921)***	***(1,029)***	***(1,146)***	***2,359***

Cost of Generation

All inputs are in blue.

Technology Assumptions	Calculation		
Project Capacity (MW)			
Capital Cost ($/kW)	Cap Cost	$	66,590
Fixed O&M ($/kW)	Fed'l depreciation basis	$	56,602
Fixed O&M Escalation	State depreciation basis	$	66,590
Variable O&M ($/MWh)			
Variable O&M Escalation	0		
Insurance (% CapEx/year)	0	-19913.59952	
Fuel Cost ($/MBtu)	5	-19634.94595	
Fuel Cost Escalation	slope	55.73071307	
Land (% royalty on revenues)			
Heat Rate (Btu/kWh)			
Production Degradation (%/year)			
Capacity Factor			

Year	12	13	14	15	16	17	18	19	20
Annual Generation (MWh)	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
Cost of Generation ($/mWh)	$357.32	$357.32	$357.32	$357.32	$357.32	$357.32	$357.32	$357.32	$357.32
Operating Revenues	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**	**$4,758**
Fixed O&M	$0	$0	$0	$0	$0	$0	$0	$0	$0
Variable O&M	$175	$179	$184	$188	$193	$198	$203	$208	$213
Insurance	$524	$537	$551	$565	$579	$593	$608	$623	$639
Land Cost	$190	$190	$190	$190	$190	$190	$190	$190	$190
Fuel Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0
Excise Tax	$24	$24	$24	$24	$24	$24	$24	$24	$24
Operating Expenses	**$913**	**$931**	**$948**	**$967**	**$986**	**$1,005**	**$1,025**	**$1,045**	**$1,066**
Interest Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Principal Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Debt Service	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Tax Depreciation - State	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - State	$3,845	$3,827	$3,809	$3,791	$3,772	$3,753	$3,733	$3,713	$3,692
State Income Tax (benefit)	$231	$230	$229	$228	$227	$226	$225	$223	$222
Tax Depreciation - Fed'l	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - Fed'l	$3,613	$3,597	$3,580	$3,563	$3,545	$3,527	$3,509	$3,490	$3,470
Federal Income Tax (benefit)	$1,265	$1,259	$1,253	$1,247	$1,241	$1,235	$1,228	$1,221	$1,214
PTC	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal ITC									
State Tax Credit									
Net Taxes (due)	**($1,496)**	**($1,489)**	**($1,482)**	**($1,475)**	**($1,468)**	**($1,460)**	**($1,453)**	**($1,445)**	**($1,437)**
Net Cash Flow	***2,349***	***2,338***	***2,327***	***2,316***	***2,304***	***2,293***	***2,281***	***2,268***	***2,255***

Tier 2 - HREA Workpaper
Case Studies and Scenario Analysis

Case 1: Northern Power - 100 kW - Commercial Application

Technology Assumptions	
Project Capacity (MW)	0.100
Capital Cost ($/kW)	$5,500
Fixed O&M ($/kW)	$50
Fixed O&M Escalation	2.5%
Variable O&M ($/MWh)	$40
Variable O&M Escalation	2.5%
Insurance (% CapEx/year)	0.6%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Land (% royalty on revenues)	4.0%
Heat Rate (Btu/kWh)	0
Production Degradation (%/year)	0.00%
Capacity Factor	29.7%

Financial/Economic Asumptions	
Debt Percentage	35%
Debt Rate	9%
Debt Term (years)	10
Economic Life (years)	20
Depreciation Term (years)	5
Percent Depreciated	100%
Cost of Generation Escalation	0.0%
Federal Tax Rate (marginal)	40%
State Tax Rate (effective)	6.015%
State Excise Tax Rate (wholesale)	0.5%
Cost of Equity	15%
Discount Rate	9%

Incentives		Cap
PTC ($/MWh)	0	0
PTC Escalation	0	0
PTC Term (years)	0	0
ITC	0.3	0
State Tax Credit	0.2	500,000
No. of Systems	1	0

Case 1: Scenario 1 - 4: State/Federal Taxes Monetized, 10 yr loan

Fit Payment Rate (CF = 29.7%) 24.7 10 year loan

Fit Payment Rate (CF = 29.7%)

21.6	11%
23.1	13%
28.3	19%

Notes on Turbines Not Considered for the Analysis in Tier 2

The following turbines should not be included for analysis and calculation of the Tier 1 FiT Payment Rate for the following reasons:

1. Jacobs 20 kW - do not believe this is a turbine being seriously consdiered by industry for Hawaii at this time
   a. Need detailed cost and performance data
   b. No way to verify performance, i.e., CF at 12 mph (at 10m) resource site
   c. No way to confirm number of turbines deployed, where, and theiir performance
   d. Hisorically Jacobs have not done well in high-speed wind areas in Hawaii
2. Aerostar 30 kW - do not believe this is a turbine seriously being considered by industry fro Hawaii at this time
   a. Need detailed cost and performance data
   b.Can't verify performance, i.e., CF at 12 mph (at 10m) resource site
   c. No way to confirm number of turbines deployed, where, and theiir performance
   d. This appears to be a new turbine in the market place
3. Wind Energy Solutions - 80 kW - this turbine might be a candidate:
   a. More adequate web-site, turbine manufactured in the Netherlands -- not sure about U. S. dealers
   b. Need to verify availability of 60 hz turbines in the U. S.
   c. This turbine does have a substantial track record with 750 turbines in the field for
   d. This turbine has been tested at the Dutch national laboratory (ECN)
   e. All this looks OK, except no U. S. dealer, so there are questions about ability to support turbines in Hawaii, etc.

Tier 2 - HREA Workpaper
Case Studies and Scenario Analysis

Summary Tier 2 Pricing

1. HREA believes the field is for Tier 2 turbines is extremely iimited at this time, which is in stark contrast for Tier 2 PV options.
2. HREA did submit data and information on the Entegrity 50 kmW wind turbine with our filing under protecitve cover on May 5, 2009. Since then, unfortunately, Entegrity has fallen into financial difficulty, and the status of the company is presently uncertain. That said, we would like to note that we still consider cost and performance estimates that we provided to the Commission to be representativ, including the proposed rate of 29 cents/kWh for the 50 kW Entegrity. Regarding that price estimate, we have the folloiwng commetns:
   a. the assumed IRR or ROE was 15%, which we believe is the minimum required to attract investors to FiT projects in Hawaii.
   b. the assumed wind resource was a Class IV (13 mph) site at 10m, resulting in a 27% capacity factor.
   c. all this suggests that the Tier 2 price should be be higher than 24.7 cents, so as to not disadvantage the smaller turbines in this Tier.

Detailed Technical Calculations and Related Assumptions

Overall Assumptions - Same as for Tier 1

1. Costs are Hawaii-specific
2. Capacity factors are based on Class 3 (12 mph) at 10m and wind shear factor of 0.18
3. Wind shear is calcluated as shown in 3.

3. Wind Shear

V (hub height)_ = V (10m)*(Zhub/10m)*POWER(α)

α =	0.18	
V (10m) =	12	mph
Z10m =	32.8	feet

Hub Height		
40	12.4	
60	13.4	
80	14.1	
121	15.2	NPS 100 hub height

Northern Calculaions*

*spec sheet: http://www.northernpower.com/pdf/specsheet-northwind100-us.pdf

Annual Output (CF=100)-kWh		876,000
Annual Output (MWH)		876.0
Avg Windspeed at Hub Height		**Capacity Factor**
12 mph		0.21
13 mph		0.25
14 mph		0.27
15 mph	$	0.297
16 mph		0.34
17 mph		0.38
18 mph		0.42

Average Annual Wind Speed (mph)	Average Annual Wind Speed (m/s)	Annual Energy Output (MWh/yr)
8.9	4	77
10	4.5	110
11	5	145
12	5.5	183
13	6	222
14	6.25	240
15	6.5	260
16	7	298
17	7.5	334
18	8	368
19	8.5	400

Cost of Generation Calculator

All inputs are in blue.

Tier 2 Wind Project - Case 1: Northern Power 100 kW Commercial Project

Technology Assumptions	
Project Capacity (MW)	0.100
Capital Cost ($/kW)	$5,500
Fixed O&M ($/kW)	$50
Fixed O&M Escalation	2.5%
Variable O&M ($/MWh)	$40
Variable O&M Escalation	2.5%
Insurance (% CapEx/year)	0.6%
Fuel Cost ($/MBtu)	$0
Fuel Cost Escalation	2.5%
Land (% royalty on revenues)	4.0%
Heat Rate (Btu/kWh)	0
Production Degradation (%/year)	0.00%
Capacity Factor	29.7%

Financial/Economic Asumptions	
Debt Percentage	35%
Debt Rate	9%
Debt Term (years)	10
Economic Life (years)	20
Depreciation Term (years)	5
Percent Depreciated	100%
Cost of Generation Escalation	0.0%
Federal Tax Rate (marginal)	40%
State Tax Rate (effective)	6.015%
State Excise Tax Rate (wholesa	0.5%
Cost of Equity	15%
Discount Rate	9%

Incentives		Cap
PTC ($/MWh)	$0	
PTC Escalation	0.0%	
PTC Term (years)	0	
ITC	30%	
State Tax Credit	20%	$ 500,000
No. of Systems	1	

Outputs	
NPV for Equity Return	$0
Levelized Cost of Generation	$246.70

Year		1	2	3	4	5	6	7	8	9	10	11
Annual Generation (MWh)		260.2	260.2	260.2	260.2	260.2	260.2	260.2	260.2	260.2	260.2	260.2
Cost of Generation ($/mWh)		$246.70	$246.70	$246.70	$246.70	$246.70	$246.70	$246.70	$246.70	$246.70	$246.70	$246.70
Operating Revenues		**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**
Fixed O&M		$5,000	$5,125	$5,253	$5,384	$5,519	$5,657	$5,798	$5,943	$6,092	$6,244	$6,400
Variable O&M		$10,407	$10,667	$10,934	$11,207	$11,487	$11,774	$12,069	$12,371	$12,680	$12,997	$13,322
Insurance		$3,300	$3,383	$3,467	$3,554	$3,643	$3,734	$3,827	$3,923	$4,021	$4,121	$4,224
Land Cost		$2,567	$2,567	$2,567	$2,567	$2,567	$2,567	$2,567	$2,567	$2,567	$2,567	$2,567
Fuel Cost		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Excise Tax		$321	$321	$321	$321	$321	$321	$321	$321	$321	$321	$321
Operating Expenses		**$21,595**	**$22,063**	**$22,542**	**$23,034**	**$23,537**	**$24,053**	**$24,583**	**$25,125**	**$25,681**	**$26,251**	**$26,835**
Interest Payment		$17,325	$16,185	$14,942	$13,587	$12,110	$10,500	$8,746	$6,833	$4,749	$2,477	$0
Principal Payment		$12,670	$13,811	$15,054	$16,408	$17,885	$19,495	$21,249	$23,162	$25,247	$27,519	$0
Debt Service		**$29,995**	**$29,995**	**$29,995**	**$29,995**	**$29,995**	**$29,995**	**$29,995**	**$29,995**	**$29,995**	**$29,995**	**$0**
Tax Depreciation - State		$110,000	$176,000	$105,600	$63,360	$63,360	$31,680	$0	$0	$0	$0	$0
Taxable Income - State		$25,264	($150,063)	($78,899)	($35,796)	($34,823)	($2,049)	$30,856	$32,226	$33,755	$35,457	$37,350
State Income Tax (benefit)		$1,520	($9,026)	($4,746)	($2,153)	($2,095)	($123)	$1,856	$1,938	$2,030	$2,133	$2,247
Tax Depreciation - Fed'l		$93,500	$149,600	$89,760	$53,856	$53,856	$26,928	$0	$0	$0	$0	$0
Taxable Income - Fed'l		$40,245	($114,637)	($58,314)	($24,139)	($23,224)	$2,826	$29,000	$30,288	$31,724	$33,324	$35,103
Federal Income Tax (benefit)		$16,098	($45,855)	($23,325)	($9,656)	($9,290)	$1,130	$11,600	$12,115	$12,690	$13,330	$14,041
PTC		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal ITC		$165,000										
State Tax Credit		$110,000										
Net Taxes (due)		**$257,382**	**$54,881**	**$28,071**	**$11,809**	**$11,384**	**($1,007)**	**($13,456)**	**($14,053)**	**($14,720)**	**($15,463)**	**($16,288)**
Net Cash Flow	***(357,500)***	***269,976***	***67,007***	***39,718***	***22,964***	***22,036***	***9,129***	***(3,849)***	***(4,989)***	***(6,212)***	***(7,524)***	***21,062***

Cost of Generation

All inputs are in blue.

Technology Assumptions	Calculation		
Project Capacity (MW)			
Capital Cost ($/kW)	Cap Cost	$	550,000
Fixed O&M ($/kW)	Fed'l depreciation basis	$	467,500
Fixed O&M Escalation	State depreciation basis	$	550,000
Variable O&M ($/MWh)			
Variable O&M Escalation	0		
Insurance (% CapEx/year)	0		-188136.5946
Fuel Cost ($/MBtu)	5		-184323.5329
Fuel Cost Escalation	slope		762.6123495
Land (% royalty on revenues)			
Heat Rate (Btu/kWh)			
Production Degradation (%/year)			
Capacity Factor			

Year	12	13	14	15	16	17	18	19	20
Annual Generation (MWh)	260.2	260.2	260.2	260.2	260.2	260.2	260.2	260.2	260.2
Cost of Generation ($/mWh)	$246.70	$246.70	$246.70	$246.70	$246.70	$246.70	$246.70	$246.70	$246.70
Operating Revenues	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**	**$64,184**
Fixed O&M	$6,560	$6,724	$6,893	$7,065	$7,241	$7,423	$7,608	$7,798	$7,993
Variable O&M	$13,655	$13,996	$14,346	$14,705	$15,072	$15,449	$15,835	$16,231	$16,637
Insurance	$4,330	$4,438	$4,549	$4,663	$4,779	$4,899	$5,021	$5,147	$5,276
Land Cost	$2,567	$2,567	$2,567	$2,567	$2,567	$2,567	$2,567	$2,567	$2,567
Fuel Cost	$0	$0	$0	$0	$0	$0	$0	$0	$0
Excise Tax	$321	$321	$321	$321	$321	$321	$321	$321	$321
Operating Expenses	**$27,433**	**$28,047**	**$28,676**	**$29,321**	**$29,981**	**$30,659**	**$31,353**	**$32,065**	**$32,794**
Interest Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Principal Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0
Debt Service	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Tax Depreciation - State	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - State	$36,751	$36,138	$35,509	$34,864	$34,203	$33,526	$32,831	$32,120	$31,390
State Income Tax (benefit)	$2,211	$2,174	$2,136	$2,097	$2,057	$2,017	$1,975	$1,932	$1,888
Tax Depreciation - Fed'l	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income - Fed'l	$34,541	$33,964	$33,373	$32,767	$32,146	$31,509	$30,857	$30,188	$29,502
Federal Income Tax (benefit)	$13,816	$13,586	$13,349	$13,107	$12,858	$12,604	$12,343	$12,075	$11,801
PTC	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal ITC									
State Tax Credit									
Net Taxes (due)	**($16,027)**	**($15,759)**	**($15,485)**	**($15,204)**	**($14,916)**	**($14,620)**	**($14,317)**	**($14,007)**	**($13,689)**
Net Cash Flow	***20,724***	***20,378***	***20,024***	***19,660***	***19,287***	***18,905***	***18,514***	***18,113***	***17,701***

CERTIFICATE OF SERVICE

The foregoing HREA Comments and Recommendations was served on the date of filing by Hand Delivery or electronically transmitted to each such Party as follows.

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